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PATENT
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Case No. 98,162)

In re Application of:)
)
DeGendt, et al.)
) Group Art Unit: 1746
Serial No.: 09/022,834)
) Examiner: Ahmed
Filed: February 13, 1998)
)
For: Method For Removing Organic)
Contaminants From A)
A Semiconductor Surface)

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SA
8/17/02

Commissioner for Patents
Washington, DC 20231

SUPPLEMENTAL DECLARATION OF STEFAN DEGENDT
PURSUANT TO 37 C.F.R. § 1.132

I, Stefan DeGendt, declare as follows:

1. I am a co-inventor of the subject matter of the above-identified patent application.
2. I received my Ph.D. of Science in January 1996.
3. I hold the position of researcher at IMEC vzw, where I have been employed since February 1996.
4. This declaration is submitted as a supplement to my declaration previously submitted for the above-referenced case.
5. I understand that the claims have been rejected based, in part, on the belief that hydrogen peroxide and ozone are functionally equivalent.

6. It is my opinion that hydrogen peroxide and ozone are not functionally equivalent when removing organic contaminants resulting from a previous lithographic step.

7. I oversaw experiments using both hydrogen peroxide and ozone in order to remove organic contaminants resulting from a previous lithographic step.

8. The following is a table of data generated from the experiments.

	Concentration (ppm)	Logarithmic Calculation of the concentration	HYDROGEN PEROXIDE thickness of organic contaminants resulting from previous lithographic step removed (nm)	OZONE thickness of organic contaminants resulting from previous lithographic step removed (nm)
Hydrogen Peroxide	300,000	5.477121	0.7	
	100,000	5	1.5	
	50,000	4.69897	0	
	10,000	4	0.6	
	50	1.69897	0.1	
	25	1.39794	0.1	
Ozone	50	1.69897		169.8
	25	1.39794		86.5
	15	1.176091		58.8

The concentration of the hydrogen peroxide was varied from 25 parts per million (ppm) to 300,000 ppm (30% of solution H_2O_2). The concentration of ozone was varied from 15 ppm to 50 ppm. Moreover, because the range of the hydrogen peroxide used was so large (from 25 ppm to 300,000 ppm), the logarithm of the concentration was calculated in order to show the results in a graph (which is enclosed). On the enclosed graph, the concentration is plotted along the x-axis and the thickness removed (in nanometers) is plotted along the y-axis.

9. For the experiments, a substrate was coated with 1.2 μm of Iline IX845 resist. This type of resist is a type of organic contaminant that results from a previous lithographic step. The substrates were placed in an 8 litre tank for a 5 minute immersion time. For each of the experiments, 5mL of acetic acid was placed in the tank. The ozone was bubbled up the tank during the 5 minute immersion time. During immersion and processing of the substrate, no contact was made between the bubbles and the resist coated side. For the hydrogen peroxide dips, oxygen (O_2) was bubbled to simulate the dynamic effect of the bubbling effect present when using ozone. . During immersion and processing of the substrate, no contact was made between the bubbles and the resist coated side. After immersion, the substrates were sprayed with rinse and blown dry with N_2 . The detection method for determining the thickness of the resist layer was 49 pts ellipsometry (spectramap (Tencor)).

10. As shown in the enclosed graph, the amount of resist removed using ozone is orders of magnitude greater than the amount of resist removed using hydrogen peroxide. As merely one example, the amount of resist removed for ozone at 50 ppm and hydrogen peroxide at 50 ppm is 169.8 nm to .1 nm, respectively. This is a difference of over three orders of magnitude. Thus, it is my conclusion that in the context of removing organic contaminants resulting from a previous lithographic step, hydrogen peroxide is not functionally equivalent to ozone.

11. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of the Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Further the declarant sayeth not.

Respectfully submitted,

12 July 2002
Date


Stefan DeGendt